

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

AMENDMENT TO THE SPECIFICATION

Please substitute the heading on page 1, line 3 as follows:

~~Technical Field of the Invention~~ BACKGROUND OF THE INVENTION

1. Field of the Invention --

Please substitute the heading on page 1, line 6 as follows:

~~Background Art of the Invention~~ 2. Discussion of the Related Art

Please substitute the heading on page 2, line 21 as follows:

~~Disclosure of the Invention~~ SUMMARY OF THE INVENTION

Please substitute the paragraph beginning at page 4, line 22
and ending at page 5, line 14 to read as follows:

-- Further, in the above-described first alignment method
according to the present invention, a method may be also employed
wherein recognition means for reading all of the respective

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

positioning recognition marks provided on both objects from lower side is used as the above-described movable recognition means, respective recognition marks are read during movement of the recognition means before its complete stop, and absolute positions of respective recognition marks are identified by correcting respective mark recognition positions having been read by the recognition means, based on position feedback signals of the recognition means sent during movement of the recognition means. [[As]] A double lens camera can also be used as this movable recognition means disposed at a lower-side position,~~a double lens camera can also be is used.~~ As such a double lens camera, a camera incorporated integrally into a movement mechanism of the camera, namely, incorporated integrally at a constant positional relationship can be used. Alternatively, the double lens camera may be constructed by incorporating two cameras being separable into a movement mechanism. Further, a method can also be employed wherein a positioning recognition mark provided on at least one object is read by transmitting a measurement wave (for example, a visual ray or an infrared ray) through an object or/and a member for receiving the object. The object or the member for receiving the object capable of

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

transmitting a measurement wave is formed, for example, from a glass. --

Please substitute the paragraph beginning at page 5, line 15 and ending at line 24 to read as follows:

-- In the above-described first alignment method, it is preferred that the reading is carried out by ~~correcting in soft~~ software revision of an aberration of a lens of the movable recognition means. In a case where a camera mechanism having a lens is used as the movable recognition means, if merely read before a complete stop during movement, because there occurs a case where the mark is read at a time when the mark has not yet reached the center of the camera, when there is an aberration or distortion of a lens, it causes an error in recognition of a position. Therefore, if the distortion of the lens is corrected, for example, by storing a reference matrix mark $[[a_s]]$ in a ~~soft~~ software matrix, even in reading at a position other than the lens center, it becomes possible to recognize $[[a]]$ an accurate position and to prevent an ~~affection to~~ obstacle to improve the accuracy. --

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

Please substitute the paragraph beginning at page 6, line 7 and ending at line 13 to read as follows:

-- In this method, it is preferred that, when the object is moved to the position possible to be read simultaneously, the object ~~is reached to~~ reaches a recognition position prior to the movable recognition means, or the object ~~is reached to~~ reaches a recognition position simultaneously with the movable recognition means. Further, it is preferred that, when the object is moved to the position possible to be read simultaneously, an absolute position of the recognition mark of the object is identified before a complete stop of a table for moving the object, based on a position feedback signal of the table. --

Please substitute the paragraph beginning at page 6, line 14 and ending at page 7, line 5 to read as follows:

-- Namely, when the recognition means is stopped, the means is hunting during a settling time. Further, even if the table is stopped, because a structural material may bend and vibrate, the recognition accuracy of the absolute position may be influenced. Therefore, if it is during movement at a constant speed rather

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

than being stopped, no vibration occurs, and as long as only the position feedback signal can be precisely recognized, the recognition accuracy of the absolute position increases.

Further, in a case where the object is moved to the position possible to be read simultaneously, the movement of the object must be completed before the recognition means reaches the position, where it is possible to be read simultaneously. If the movement of the object is late, it is necessary that the recognition means stops and ~~wait, if~~ waits. If so, a vibration may occur as described above and the recognition accuracy of the absolute position may be influenced. Therefore, ~~so as that the object is reached prior to the recognition means,~~ the movement timing and the movement speed of the recognition means are adjusted beforehand, so that the object is reached prior to the recognition means. Further, a condition, where during the movement of the object, the recognition means is also during movement, and they cross just at a reading position, can realize a timing capable of measuring at a best condition in vibration. If such a condition is calculated beforehand and the movement timing and the movement speed are set beforehand, it becomes possible to always recognize at an optimum condition. --

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

Please substitute the paragraph beginning at page 7, line 6 and ending at line 25 to read as follows:

-- Further, in the above-described first and second alignment methods, when the recognition mark is read using the recognition means during its movement, in order to prevent reduction of position recognition accuracy by the enlargement of the recognition mark in the movement direction due to influence of movement speed as shown in Fig. 3, it is preferred to shorten an exposure time of a shutter of the recognition means. For example, using an electronic shutter, the exposure time thereof is set at 1/100 second or less, preferably at 1/1000 second or less, whereby it becomes possible to prevent the above-described mark enlarging recognition. However, if the exposure time of the electronic shutter is set at 1/1000 second or less for example, the image becomes dark because of a lack of an amount of light. Although it is considered to use a strong light source in order to increase the amount of light, if the light of such a strong light source is ~~much taken~~ used, for example, as shown in Fig. 4, when a recognition mark G is read, ~~Sumear~~ smear phenomenon may occur such that lines H trailed by ~~[[the]]~~ a strong ray appear, and there is a fear that the position recognition accuracy is

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

reduced by this ~~Sumear~~ smear phenomenon. Accordingly, in order to suppress the influence of this ~~Sumear~~ smear phenomenon to as little as possible, it is possible to substantially extinguish the lines H due to ~~Sumear~~ smear phenomenon by using a stroboscopic emission carried out synchronously with the exposure time due to the electronic shutter together with the electronic shutter, thereby preventing the reduction of the position recognition accuracy. --

Please substitute the paragraph beginning at page 8, line 5 and ending at line 11 to read as follows:

-- The above-described one object comprises, for example, a chip, and the other object comprises, for example, a substrate. In the present invention, however, the "chip" means all objects with forms being bonded to a substrate regardless of the kind and size, such as an IC chip, a semiconductor chip, an optoelectronic element, a surface mounting part and a wafer. Further, the "substrate" means all objects with forms being bonded to a chip regardless of the kind and size, such as a resin substrate, a glass substrate, a film substrate, a chip and a wafer. --

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

Please substitute the heading on page 8, line 18 as follows:

~~Brief explanation of the drawings~~ BRIEF DESCRIPTION OF THE
DRAWINGS

Please substitute the paragraph on page 9, line 1 to read as follows:

-- Fig. 4 is a plan view of a recognition mark showing
~~Sumear~~ smear phenomenon. --

Please substitute the paragraph beginning at page 9, line 4
and ending at line 6 to read as follows:

-- Fig. 6 is an explanation diagram showing an example
of relationship between ~~[[an]]~~ a movement demand and a
coordinate of a movement axis in a movable recognition
means. --

Please substitute the heading on page 10, line 4 as follows:

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

The Best mode for carrying out the Invention DETAILED DESCRIPTION
OF THE PREFERRED EMBODIMENTS

Please substitute the paragraph beginning at page 11, line 10 and ending at line 22 to read as follows:

-- In a case where upper and lower recognition marks cannot be read simultaneously as they are, for example, in a case where an adhesive or a film is provided on one object side and a recognition mark is provided at a position outside of the object, it becomes possible to read both of the upper and lower recognition marks simultaneously by shifting a position of the recognition mark of one object by a predetermined amount together with the object. Because this forcible shifting amount is a known amount, it can be easily and precisely corrected when both objects are positioned to each other. For example, as shown in Fig. 7, the position of second object 4 is forcibly shifted by moving stage 3 so that recognition mark A and recognition mark C' come to the same position vertically, and at this state, upper and lower recognition marks A and C' may be read simultaneously and synchronously. This forcible ~~sifting~~ shifting movement amount may be corrected at the time of positioning of both

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

objects. A similar method can be employed for recognition marks B and D'. --

Please substitute the paragraph beginning at page 13, line 6 and ending at line 17 to read as follows:

-- In the flow shown in Fig. 9, a head holding a first object (for example, a chip) is moved to a position of a height for reading a recognition mark, and a two-sight recognition means is ~~in-serted~~ inserted between the first object and a second object (for example, a substrate). A stage is moved so that a recognition mark C' can be read within the same vertical sight as that for a recognition mark A. After movement of the mark, during movement of the two-sight recognition means, an encoder feedback pulse of a movement axis before complete stop is read as a mark recognition position, as well as images of recognition marks A, C' are read simultaneously and synchronously by upper and lower cameras of the two-sight recognition means. Even in this case, in a case where the complete stop of the stage side is difficult relative to the camera movement time, it is preferred to also read a feedback pulse of an encoder on a table of the

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

stage side. Further, a linear scale is ~~[[more]]~~ preferable
~~[[than]]~~ to the encoder. --

Please substitute the paragraph beginning at page 15, line
10 and ending at line 16 to read as follows:

-- Further, as aforementioned, if an exposure time is
shortened by ~~using~~ using an electronic shutter when reading the
recognition marks, an enlargement phenomenon of read mark as
shown in Fig. 3 can be prevented, and even when a strong light
source is used in order to further shorten the exposure time, if
a stroboscopic emission is carried out synchronously with the
exposure, it becomes possible to suppress ~~Sumear~~ smear phenomenon
as shown in Fig. 4 to as little as possible, and ~~a further high~~
an even higher accuracy of position recognition can be achieved.

--

Please substitute the paragraph on page 18, line 7 to read
as follows:

-- ~~Where, the~~ The above-described step (2) may be changed
with the step (3). --

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

Please substitute the paragraph on page 19, line 13 to read as follows:

-- ~~Where, the~~ The above-described step (2) may be changed with the step (3). --

Please substitute the paragraph beginning at page 19, line 14 and ending at line 22 to read as follows:

-- Thus, ~~[[in]]~~ for the alignment method and the mounting method using the alignment method according to the present invention, various embodiments can be employed. In the alignment method and the mounting method using the alignment method according to the present invention, by reading upper and lower alignment marks simultaneously, the accuracy increases as compared with that in a conventional technology, it is not necessary to assure a settling time for complete stop of a movable recognition means, and the alignment time and the mounting tact can be greatly shortened. Further, if an electronic shutter and a stroboscope are used at the time of

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

reading a recognition mark, ~~a further high~~ an even higher
accuracy for recognition of positions can be achieved. --

Please delete the heading beginning on page 19, line 23 and
ending at line 23 as follows:

~~Industrial Applications of the Invention~~

Please substitute the heading on page 21, line 1 as
follows:

CLAIMS What is claimed is:

Please substitute the heading on page 31, line 1 as follows:

ABSTRACT ABSTRACT OF THE DISCLOSURE

Please substitute the abstract to read as follows:

-- Positioning recognition marks ~~(A, B, C, D)~~ are read
by movable recognition ~~means (5)~~ device for positioning
objects ~~(2, 4)~~ to be bonded to each other. An alignment

Application No.: 10/509,882
Amendment under 37 CFR 1.111
Reply to Office Action dated April 9, 2007
July 9, 2007

method includes a step of reading the recognition marks ~~(A, B, C, D)~~ during movement of the recognition ~~means~~ ~~(5)~~ device before its complete stop, and a step of identifying absolute positions of the recognition marks ~~(A, B, C, D)~~ by correcting the mark recognition positions having been read based on a position feedback signal of the moving recognition ~~means~~ ~~(5)~~ device. A mounting method using the alignment method is also disclosed. It is possible to maintain a high alignment accuracy, eliminate necessity of assuring a settling time for complete stop of the movable recognition ~~means~~ ~~(5)~~ device, and significantly reduce the alignment time and mounting tact. --